# 74LVC1G386

## 3-input EXCLUSIVE-OR gate

Rev. 4 — 9 May 2017 Product data sheet

## 1 General description

The 74LVC1G386 provides a 3-input EXCLUSIVE-OR function.

The input can be driven from either 3.3 or 5 V devices. This feature allows the use of these devices in a mixed 3.3 and 5 V environment.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall time.

This device is fully specified for partial power-down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

## 2 Features and benefits

- Wide supply voltage range from 1.65 to 5.5 V
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8B/JESD36 (2.7 V to 3.6 V)
- ±24 mA output drive ($V_{CC}$ = 3.0 V)
- Latch-up performance exceeds 250 mA
- CMOS low power consumption
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- ESD protection:
  - HBM EIA/JESD22-A114E exceeds 2 000 V
  - MM EIA/JESD22-A115-A exceeds 200 V.
- SOT363 and SOT457 package
- Specified from -40 to +85 °C and -40 to +125 °C.

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## 3 Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74LVC1G386GW | -40 °C to +125 °C | SC-88 | plastic surface-mounted package; 6 leads | SOT363 |
| 74LVC1G386GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package (TSOP6); 6 leads | SOT457 |

## 4 Marking

**Table 2. Marking**

| Type number | Marking code [1] |
|---|---|
| 74LVC1G386GW | YH |
| 74LVC1G386GV | YH |

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 5 Functional diagram

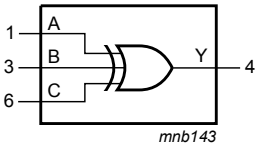



**Figure 1. Logic symbol**

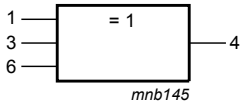



**Figure 2. IEC logic symbol**

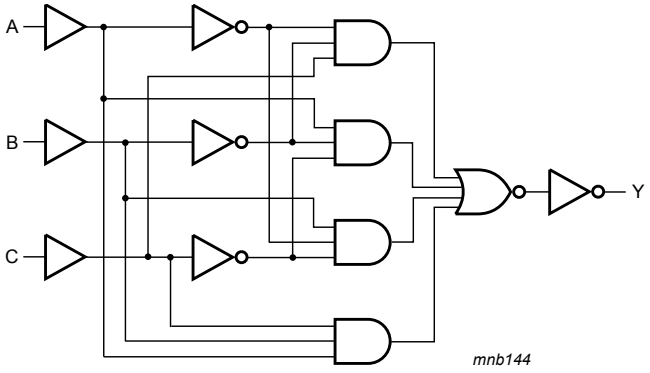



**Figure 3. Logic diagram**

# 6 Pinning information

## 6.1 Pinning

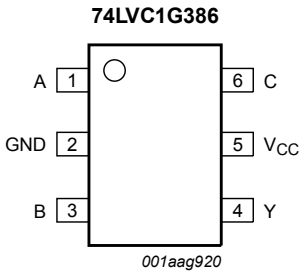



**Figure 4. Pin configuration**

## 6.2 Pin description

**Table 3. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| A | 1 | data input |
| GND | 2 | ground (0 V) |
| B | 3 | data input |
| Y | 4 | data output |
| $V_{CC}$ | 5 | supply voltage |
| C | 6 | data input |

# 7 Functional description

**Table 4. Function table [1]**

| Input | | | Output |
|---|---|---|---|
| A | B | C | Y |
| L | L | L | L |
| L | L | H | H |
| L | H | L | H |
| L | H | H | L |
| H | L | L | H |
| H | L | H | L |
| H | H | L | L |
| H | H | H | H |

[1] H = HIGH voltage level;
L = LOW voltage level

# 8 Limiting values

**Table 5. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | -0.5 | +6.5 | V |
| $I_{IK}$ | input clamping current | $V_I < 0$ V | -50 | - | mA |
| $V_I$ | input voltage | [1] | -0.5 | +6.5 | V |
| $I_{OK}$ | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | - | ±50 | mA |
| $V_O$ | output voltage | Active mode [1] [2] | -0.5 | $V_{CC}$ + 0.5 | V |
| | | Power-down mode [1] [2] | -0.5 | +6.5 | V |
| $I_O$ | output current | $V_O$ = 0 V to $V_{CC}$ | - | ±50 | mA |
| $I_{CC}$ | supply current | | - | 100 | mA |
| $I_{GND}$ | ground current | | -100 | - | mA |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = -40 °C to +125 °C [3] | - | 250 | mW |
| $T_{stg}$ | storage temperature | | -65 | +150 | °C |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] When $V_{CC}$ = 0 V (Power-down mode), the output voltage can be 5.5 V in normal operation.
[3] For SC-74 and SC-88 packages: above 87.5 °C the value of $P_{tot}$ derates linearly with 4.0 mW/K.

# 9 Recommended operating conditions

**Table 6. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 1.65 | - | 5.5 | V |
| $V_I$ | input voltage | | 0 | - | 5.5 | V |
| $V_O$ | output voltage | Active mode | 0 | - | $V_{CC}$ | $V_O$ |
| | | $V_{CC}$ = 0 V; Power-down mode | 0 | - | 5.5 | $V_O$ |
| $T_{amb}$ | ambient temperature | | -40 | - | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 1.65 V to 2.7 V | - | - | 20 | ns/V |
| | | $V_{CC}$ = 2.7 V to 5.5 V | - | - | 10 | ns/V |

## 10 Static characteristics

**Table 7. Static characteristics**

*At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Typ [1] | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{amb}$ = -40 °C to +85 °C | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | 0.65 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2.0 | - | - | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | 0.7 × $V_{CC}$ | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | - | - | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.3 × $V_{CC}$ | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -100 µA; $V_{CC}$ = 1.65 V to 5.5 V | $V_{CC}$ - 0.1 | - | - | V |
| | | $I_O$ = -4 mA; $V_{CC}$ = 1.65 V | 1.2 | - | - | V |
| | | $I_O$ = -8 mA; $V_{CC}$ = 2.3 V | 1.9 | - | - | V |
| | | $I_O$ = -12 mA; $V_{CC}$ = 2.7 V | 2.2 | - | - | V |
| | | $I_O$ = -24 mA; $V_{CC}$ = 3.0 V | 2.3 | - | - | V |
| | | $I_O$ = -32 mA; $V_{CC}$ = 4.5 V | 3.8 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 100 µA; $V_{CC}$ = 1.65 V to 5.5 V | - | - | 0.1 | V |
| | | $I_O$ = 4 mA; $V_{CC}$ = 1.65 V | - | - | 0.45 | V |
| | | $I_O$ = 8 mA; $V_{CC}$ = 2.3 V | - | - | 0.3 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V | - | - | 0.4 | V |
| | | $I_O$ = 24 mA; $V_{CC}$ = 3.0 V | - | - | 0.55 | V |
| | | $I_O$ = 32 mA; $V_{CC}$ = 4.5 V | - | - | 0.55 | V |
| $I_I$ | input leakage current | $V_{CC}$ = 0 V to 5.5 V; $V_I$ = 5.5 V or GND | - | ±0.1 | ±1 | µA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 5.5 V | - | ±0.1 | ±2 | µA |
| $I_{CC}$ | supply current | $V_I$ = 5.5 V or GND; $V_{CC}$ = 1.65 V to 5.5 V; $I_O$ = 0 A | - | 0.1 | 4 | µA |
| $\Delta I_{CC}$ | additional supply current | per pin; $V_{CC}$ = 2.3 V to 5.5 V; $V_I$ = $V_{CC}$ - 0.6 V; $I_O$ = 0 A | - | 5 | 500 | µA |
| $C_I$ | input capacitance | $V_{CC}$ = 3.3 V; $V_I$ = GND to $V_{CC}$ | - | 4 | - | pF |
| $T_{amb}$ = -40 °C to +125 °C | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | 0.65 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2.0 | - | - | V |

| Symbol | Parameter | Conditions | Min | Typ [1] | Max | Unit |
|---|---|---|---|---|---|---|
| | | $V_{CC}$ = 4.5 V to 5.5 V | 0.7 × $V_{CC}$ | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | - | - | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.3 × $V_{CC}$ | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -100 µA; $V_{CC}$ = 1.65 V to 5.5 V | $V_{CC}$ - 0.1 | - | - | V |
| | | $I_O$ = -4 mA; $V_{CC}$ = 1.65 V | 0.95 | - | - | V |
| | | $I_O$ = -8 mA; $V_{CC}$ = 2.3 V | 1.7 | - | - | V |
| | | $I_O$ = -12 mA; $V_{CC}$ = 2.7 V | 1.9 | - | - | V |
| | | $I_O$ = -24 mA; $V_{CC}$ = 3.0 V | 2.0 | - | - | V |
| | | $I_O$ = -32 mA; $V_{CC}$ = 4.5 V | 3.4 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 100 µA; $V_{CC}$ = 1.65 V to 5.5 V | - | - | 0.1 | V |
| | | $I_O$ = 4 mA; $V_{CC}$ = 1.65 V | - | - | 0.70 | V |
| | | $I_O$ = 8 mA; $V_{CC}$ = 2.3 V | - | - | 0.45 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V | - | - | 0.60 | V |
| | | $I_O$ = 24 mA; $V_{CC}$ = 3.0 V | - | - | 0.80 | V |
| | | $I_O$ = 32 mA; $V_{CC}$ = 4.5 V | - | - | 0.80 | V |
| $I_I$ | input leakage current | $V_{CC}$ = 0 V to 5.5 V; $V_I$ = 5.5 V or GND | - | - | ±1 | µA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 5.5 V | - | - | ±2 | µA |
| $I_{CC}$ | supply current | $V_I$ = 5.5 V or GND; $V_{CC}$ = 1.65 V to 5.5 V; $I_O$ = 0 A | - | - | 4 | µA |
| $\Delta I_{CC}$ | additional supply current | per pin; $V_{CC}$ = 2.3 V to 5.5 V; $V_I$ = $V_{CC}$ - 0.6 V; $I_O$ = 0 A | - | - | 500 | µA |

[1] All typical values are measured at $V_{CC}$ = 3.3 V and $T_{amb}$ = 25 °C.

# 11 Dynamic characteristics

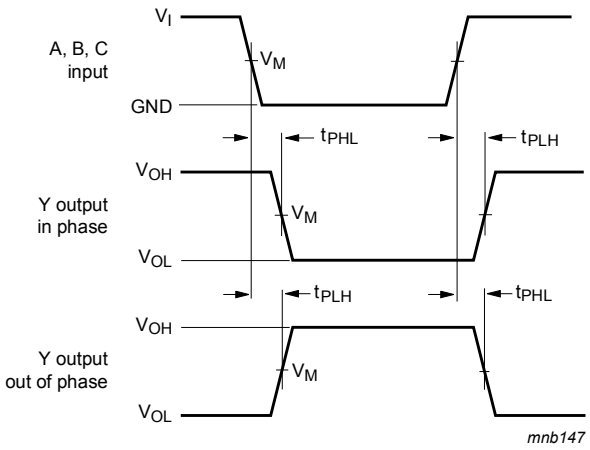
**Table 8. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 6.*

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ [1] | Max | Min | Max | |
| $t_{pd}$ | propagation delay | A, B, C to Y; see Figure 5 [2] | | | | | | |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 2.0 | 8.0 | 17.0 | 2.0 | 22.0 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.5 | 5.0 | 9.0 | 1.5 | 11.5 | ns |
| | | $V_{CC}$ = 2.7 V | 1.5 | 5.0 | 8.5 | 1.5 | 11.0 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 4.5 | 7.5 | 1.0 | 9.5 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V | 1.0 | 3.5 | 5.5 | 1.0 | 7.0 | ns |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$; $V_{CC}$ = 3.3 V [3] | - | 13 | - | - | - | pF |

[1] Typical values are measured at $T_{amb}$ = 25 °C and $V_{CC}$ = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.
[2] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$.
[3] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ where:
$f_i$ = input frequency in MHz;
$f_o$ = output frequency in MHz;
$C_L$ = output load capacitance in pF;
$V_{CC}$ = supply voltage in V;
N = number of inputs switching;
$\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

## 11.1 Waveforms and test circuit



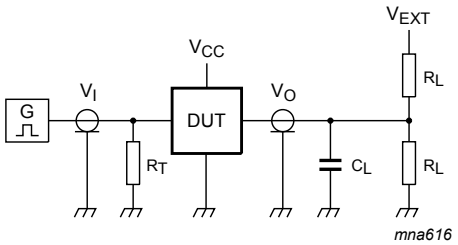

Measurement points are given in Table 9.

$V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load.

**Figure 5. Input A, B, C to output Y propagation delays**

**Table 9. Measurement points**

| $V_{CC}$ | $V_M$ | Input | |
|---|---|---|---|
| | | $V_I$ | $t_r = t_f$ |
| 1.65 V to 1.95 V | 0.5 × $V_{CC}$ | $V_{CC}$ | ≤ 2.0 ns |
| 2.3 V to 2.7 V | 0.5 × $V_{CC}$ | $V_{CC}$ | ≤ 2.0 ns |
| 2.7 V | 1.5 V | 2.7 V | ≤ 2.5 ns |
| 3.0 V to 3.6 V | 1.5 V | 2.7 V | ≤ 2.5 ns |
| 4.5 V to 5.5 V | 0.5 × $V_{CC}$ | $V_{CC}$ | ≤ 2.5 ns |




Test data is given in Table 10.

Definitions for test circuit:

$R_L$ = Load resistance.

$C_L$ = Load capacitance including jig and probe capacitance.

$R_T$ = Termination resistance should be equal to the output impedance $Z_o$ of the pulse generator.

$V_{EXT}$ = External voltage for measuring switching times.

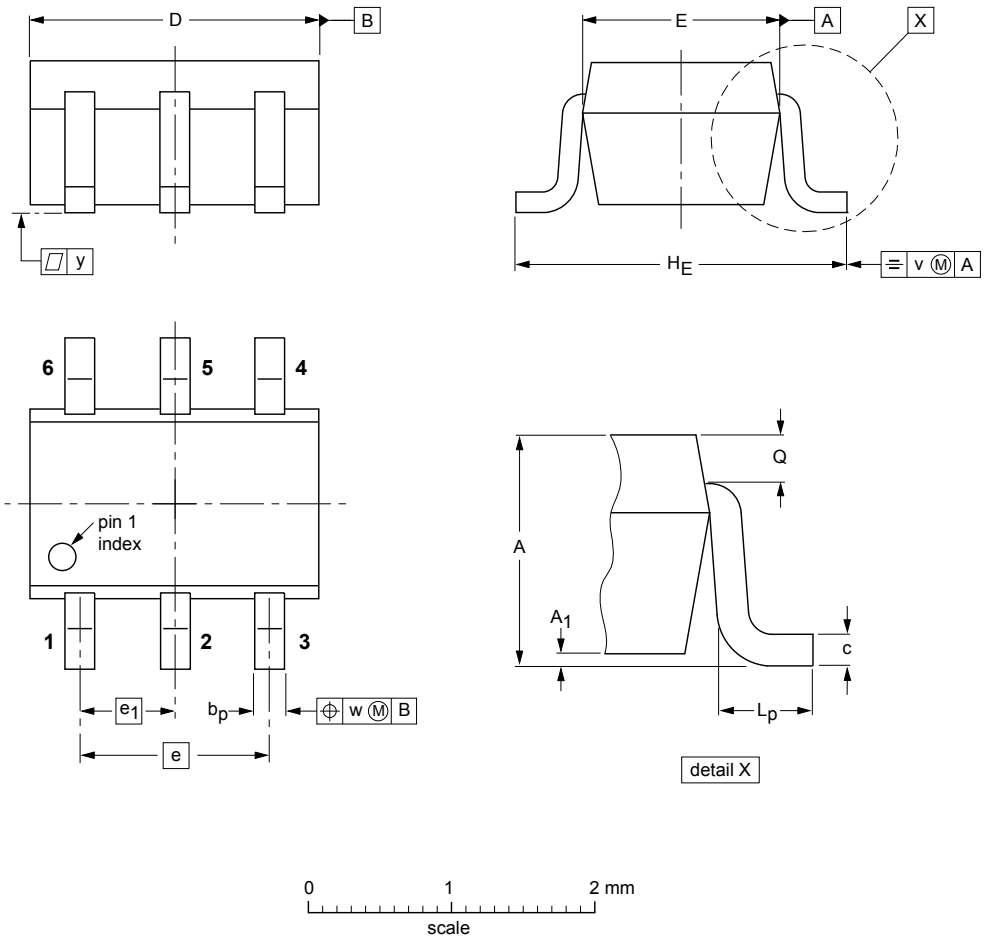
**Figure 6. Test circuit for measuring switching times**

**Table 10. Test data**

| Supply voltage | Input | Load | | $V_{EXT}$ |
|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ |
| 1.65 V to 1.95 V | $V_{CC}$ | 30 pF | 1 kΩ | open |
| 2.3 V to 2.7 V | $V_{CC}$ | 30 pF | 500 Ω | open |
| 2.7 V | 2.7 V | 50 pF | 500 Ω | open |
| 3.0 V to 3.6 V | 2.7 V | 50 pF | 500 Ω | open |
| 4.5 V to 5.5 V | $V_{CC}$ | 50 pF | 500 Ω | open |

## 12 Package outline

**Plastic surface-mounted package; 6 leads** **SOT363**



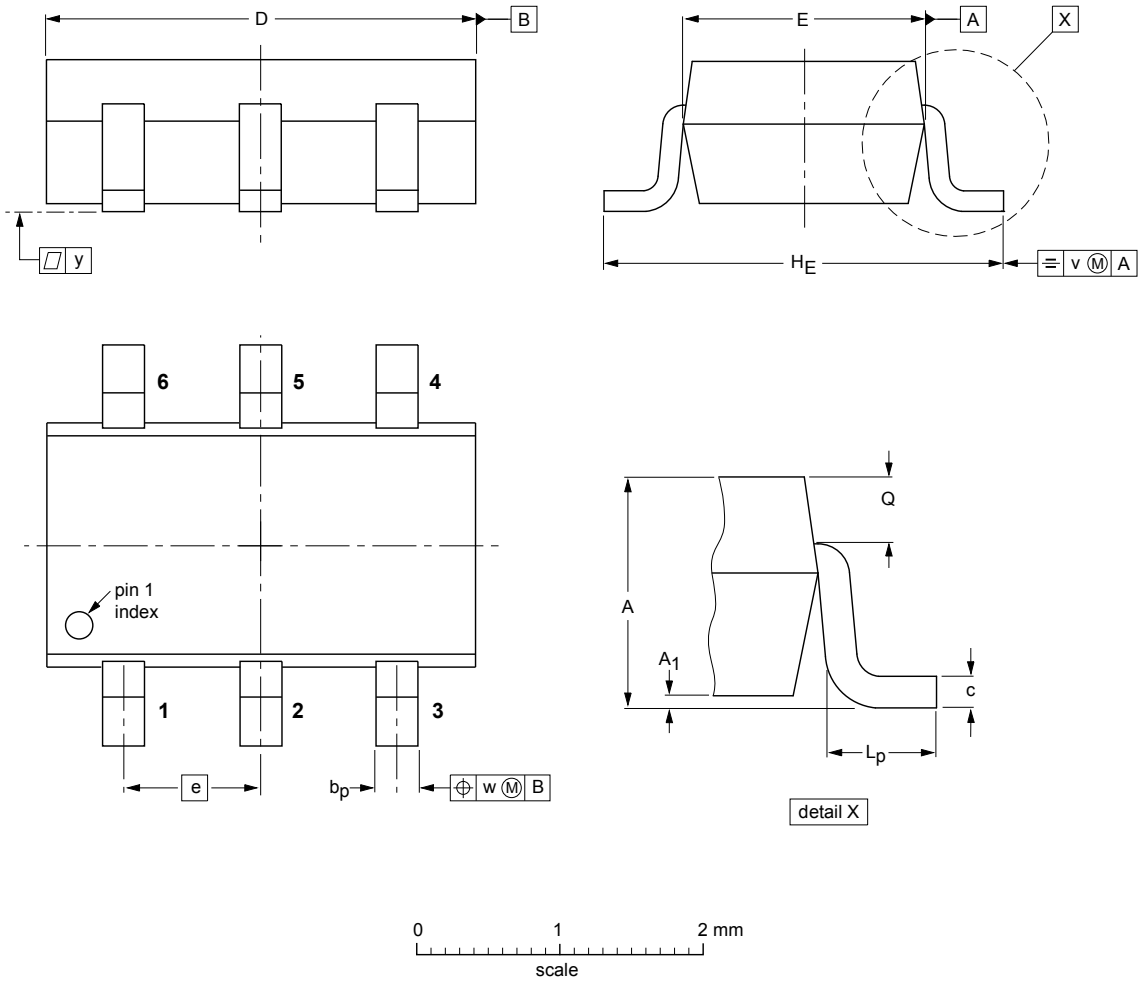

**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ max | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | Q | v | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1<br>0.8 | 0.1 | 0.30<br>0.20 | 0.25<br>0.10 | 2.2<br>1.8 | 1.35<br>1.15 | 1.3 | 0.65 | 2.2<br>2.0 | 0.45<br>0.15 | 0.25<br>0.15 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT363 | | | SC-88 | | | ~~04-11-08~~<br>06-03-16 |

**Figure 7. Package outline SOT363 (SC-88)**

**Plastic surface-mounted package (TSOP6); 6 leads** **SOT457**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | $b_p$ | c | D | E | e | $H_E$ | $L_p$ | Q | v | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1<br>0.9 | 0.1<br>0.013 | 0.40<br>0.25 | 0.26<br>0.10 | 3.1<br>2.7 | 1.7<br>1.3 | 0.95 | 3.0<br>2.5 | 0.6<br>0.2 | 0.33<br>0.23 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT457 | | | SC-74 | | | ~~05-11-07~~<br>06-03-16 |

**Figure 8. Package outline SOT457 (SC-74)**

## 13 Abbreviations

**Table 11. Abbreviations**

| Acronym | Description |
|---|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

## 14 Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74LVC1G386 v.4 | 20170509 | Product data sheet | - | 74LVC1G386 v.3 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate | | | |
| 74LVC1G386 v.3 | 20161207 | Product data sheet | - | 74LVC1G386 v.2 |
| Modifications: | • Table 7: The maximum limits for leakage current and supply current have changed. | | | |
| 74LVC1G386 v.2 | 20121119 | Product data sheet | - | 74LVC1G386 v.1 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• In Section 10 "Static characteristics", changed conditions for input leakage and supply current. | | | |
| 74LVC1G386 v.1 | 20031104 | Product specification | - | |

# 15 Legal information

## 15.1 Data sheet status

| Document status[1][2] | Product status[3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nexperia.com.

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